

Translation

Appln. No.: PCT/EP2004/011304  
Attorney Docket No.: 14603-022US1  
Client Ref.: P2003,0796

Patent Claims:

1. An optoelectronic component with a semiconductor chip (2) which chip has at least one radiation-sensitive zone (7, 8, 9) for  
5 detection of electromagnetic radiation (17), and with an optical element for focusing the electromagnetic radiation (17) in the radiation-sensitive zone(s) (7, 8, 9); characterized in that the optical element is a diffractive element (1) which has structures (14, 15) which are on the order of magnitude of the wavelength of  
10 the electromagnetic radiation (17).
2. An optoelectronic component according to claim 1; characterized in that the diffractive element (1) is a zone plate.
- 15 3. An optoelectronic component according to claim 1 or 2; characterized in that the diffractive element (1) is incorporated in the semiconductor chip (2).
4. An optoelectronic component according to one of claims 1-  
20 3; characterized in that the radiation (17) which is to be detected has a wavelength between 100 nm and 5 micron.
5. An optoelectronic component according to claim 4; characterized in that the radiation (17) which is to be detected is

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in the visible spectral region of c. 400-800 nm.

6. An optoelectronic component according to one of the preceding claims; characterized in that the distance between the  
5 diffractive element (1) and a radiation-sensitive zone (7, 8, 9) is less than 20 micron.

7. An optoelectronic component according to one of claims 2-6; characterized in that radiation with wavelength  $\lambda$  is  
10 detected in a radiation-sensitive zone (7, 8, 9) at a distance  $R$  from the zone plate (1) which zone plate has diameter  $D$ , wherewith for the Fresnel number  $F$  of the zone plate (1) the following applies:

$$F = (D^2 / \lambda R) > 1$$

8. An optoelectronic component according to one of claims 2-7; characterized in that the focal length of the zone plate (1)  
for radiation with wavelength 550 nm is in the range 1-20 micron.

9. An optoelectronic component according to one of the preceding claims; characterized in that the semiconductor chip  
(2) has a plurality of radiation-sensitive zones (7, 8, 9),  
wherewith the radiation-sensitive zones for shorter wavelengths are

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disposed behind (downstream of) the radiation-sensitive zones for longer wavelengths, reckoned in the direction of the incident radiation (17).

5           10.    An optoelectronic component according to claim 9; characterized in that the radiation-sensitive zones (7, 8, 9) are disposed in respective focal planes (11, 12, 13) of the diffractive element (1) for respective colors.

10           11.    An optoelectronic component according to claim 10; characterized in that the semiconductor chip (2) contains three radiation-sensitive zones (7, 8, 9) disposed in respective focal planes (11, 12, 13) of the diffractive element (1) for respective primary colors (red, green, blue).

15           12.    An optoelectronic component according to one of the preceding claims; characterized in that the diffractive element (1) is produced by structuring of a layer which layer is applied to the semiconductor chip (2) or which layer is contained in the  
20 semiconductor chip (2).

          13.    An optoelectronic component according to claim 12; characterized in that the structured layer is a metallic layer.

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14. An optoelectronic component according to one of claims 2-13; characterized in that the zone plate (1) is in the form of a phase zone plate comprised of two transparent materials (14, 15) with different indices of refraction ( $n_1$ ,  $n_2$ ).

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15. An optoelectronic component according to claim 14; characterized in that one of the two materials is a silicon oxide and the other material is a silicon nitride.

10 16. A method of fabricating an optoelectronic component according to one or more of the preceding claims; characterized in that the diffractive optical element (1) is produced by structuring of a layer which layer is applied to the semiconductor chip (2) or which layer is contained in the semiconductor chip (2).

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17. An optoelectronic component according to claim 16; characterized in that the semiconductor chip (2) contains an integrated circuit.

20 18. Use of a zone plate (1) for focusing and/or for wavelength selection of electromagnetic radiation (17) in (into) one or more radiation-sensitive zones (7, 8, 9) of a radiation-detecting semiconductor chip (2).